

## CALCULATING THE EPISTEMIC EFFECT OF PAST MODALITY VIA *K*

Alda Mari<sup>1</sup> & Susan Schweitzer<sup>2,1</sup>  
 1. IJN, CNRS/ENS/EHESS 2. CUNY

**Data and previous proposals.** In recent analyses of epistemic modals in the present and past in French, various authors have refuted the *syntactic scope* hypothesis (1-c) that the modal scopes above tense in the epistemic reading ([1]; [6]; [9]), and have made different proposals for modalities in the present perfect and the imperfective in French (and Dutch [1]). Here we focus on Italian (in comparison with French).

- (1) a. Jean peut<sub>pres</sub> avoir déplacé<sub>perfective</sub> la table  
*John could<sub>pres</sub> have moved the table*  
 b. Jean a pu<sub>present perfect</sub> déplacer<sub>imperfective</sub> la table (EPISTEMIC / CIRCUMSTANTIAL)  
*John might have moved the table / John could move the table*  
 c. Epistemic : MOD > TENSE > P      Circumstantial : TENSE > MOD > P

The common assumption of 'non syntactic scope' approaches is that the *meaning* of tenses/aspects determines their interpretation. It has been proposed that for the imperfective epistemic modal *pouvoir / can*, tense scopes over the modal and refers to a past time at which different epistemic possibilities were available to the speaker (2-a) ([1]; [6]). This is argued to be the case in virtue of the fact that the imperfective is an anaphoric tense ([1]).

- (2) a. (Context : Jack Bauer testifies before a commission ...  
 The President was eventually released safe)  
 Le président pouvait/devait<sub>imperfect</sub> être déjà mort, donc j'ai appelé le vice-président  
*The president could/must have been already dead, hence I have called the vice-president*

This hypothesis does not seem to cover scenario (3) in Italian, where the options considered were not available to the speaker at the time they obtained (i.e. in the past).

- (3) In a museum, in front of the very short bed of Louis XIV I can utter :  
 Poteva essere particolarmente basso *He might have been particularly short*

Moreover, even postulating that the imperfective is anaphoric to the time at which the evidence holds, it remains to be explained why, in Italian, when the imperfective is combined with eventive predicates, present evaluation of the modality only leads to the counterfactual interpretation (4), whereas past evaluation is simply not allowed on an epistemic reading.

- (4) (\*)Poteva prendere il treno ! / *He could take the train*

As for epistemic modality in the present perfect (which has an epistemic reading in Italian only when combined with stative properties (5)(i.), lexicalist approaches (e.g. [10]) have argued that, for French, the present perfect is also a point of view aspect. This hypothesis encounters theoretical and empirical shortcomings : (i) if the tense is responsible for the epistemic interpretation of the modal, it remains unclear under what circumstances the abilitative interpretation of (1-b) arises, (ii) it does not cover a variety of data across romance languages which allow the epistemic interpretation of the modal in the simple past (5)(ii.); see also [8] for Spanish), which [10] does not consider to be a point of view aspect.

- (5) (i) Ha potuto<sub>pres.perfect</sub> / (ii) Poté<sub>simple.past</sub> benissimo essere stato donato dal curatore stesso / *It could well be donated by the curator himself* (Internet example, see also [9])

Here we argue for a formal *semantic-pragmatic* approach, according to which the epistemic interpretation of sentences with modals in the past (assuming that all heads are interpreted *in situ*) is derived by a computation of inferences, given the semantic material provided by the modal and its aspect, the embedded event (whether stative or eventive), assumptions about time, plus some constraints given by the model.

**Analysis.** We employ a  $W \times T$  forward branching structure [2]. A three place relation  $\simeq$  on  $T \times W \times W$  is defined, s.t.  
 (i) for all  $t \in T$   $\simeq_t$  is an equivalence relation ; (ii) for any  $w, w' \in W$  and  $t, t' \in T$ , if  $w' \simeq_t w$  and  $t' \prec t$  then  $w' \simeq_{t'} w$ .  
 In words : any two worlds (which are maximal sets of times) overlap until they branch. We assume that  $\tau(e, w)$  returns

the spatio/temporal trace of an event  $e$  in the world  $w$ . We also assume that the imperfect over the modal returns the set of times that extend from some point in the past to an unspecified subsequent time and that the present perfect and the simple past denote a bounded past period of time.

We examine four types of past possibility of a proposition  $\phi$  as in (6-c)-((7-c). For each of the two cases, the event in  $\phi$  can be either eventive or stative, and can be scoped over by a modal that is either bounded or unbounded in aspect. The speaker can be in one of three epistemic states with respect to  $\phi$ : i) he believes it obtained, ii) he believes it did not obtain, or iii) he has no view on the matter. We ignore the first possibility, as a speaker would conventionally express this as *PAST*  $\phi$  (i.e. with no modal). We argue that the hearer can calculate which of the other two possibilities obtains as an implicature of the form of the modal the speaker elects to use. In order to formalize the epistemic dimension of ii) and iii), we introduce an operator  $K_j$  with the intended interpretation ‘the speaker ( $j$ ) believes that’ (see [5]), which is not part of the truth conditions (vs. [7]). We conventionally use  $\diamond$  to symbolize nomological possibility. We note that  $K$  is a factive operator (i.e.  $K[\phi]$  entails  $\phi$  in  $w, t$ ; consequently,  $K[\diamond\phi]$  entails  $\diamond\phi$  in  $w, t$ ). We write as  $\phi_{bounded/unbounded}$  a proposition in which the eventuality is either bounded or unbounded.

When **imperfective** aspect scopes above the modal, (6-c) applies.

- (6) a. Mario poteva<sub>imperfect</sub> prendere il treno / *Mario could have taken the train* - counterfactual/circumst.  
 b. Mario poteva<sub>imperfect</sub> star prendendo il treno / *Mario could have been taking the train*  
 c. Speaker utters  $\phi$  :  $\phi = \lambda t \lambda w \lambda P \exists t' \exists w' (t' \prec now \wedge w' \simeq_{t'} w \wedge \exists e (P(e) \wedge \tau(e)(w') \supseteq [t', \_]))$   
 Hearer :  $K_j[\lambda t \lambda w [(\phi)]^{w,t}] = 1$  iff  $\phi \in \langle w, t \rangle$

The epistemic interpretation is unavailable when a possible past **event** is referred to using the imperfect (unbounded) (i.e. *PAST(UNBND)( $\diamond(\phi_{bounded})$ )*) as in (6-a). Note that the available readings are counterfactual or circumstantial. By his use of the imperfect aspect, the speaker fails in fact to state that the possibility (of  $\phi$ ) has a definite endpoint. He thereby conveys that an event in the past, which no longer has the possibility of occurring in the actual world (e.g. a train’s departure at a certain time), is still possible. The only option available to the hearer is to assume that the speaker is referring to a *non-actual* world where this possibility is still open. The hearer can thus calculate as follows : if the only way to make  $\diamond\phi$  true is to consider a non-actual world, then, assuming truth entails possibility, the speaker must believe that  $\phi$  is not true in the actual world ( $K_j\neg\phi$ ).

The case is different with stative verbs. When the utterance contains a stative verb under an imperfective modal, as in *PAST(UNBND)( $\diamond(\phi_{unbounded})$ )* (6-b), the speaker’s utterance demonstrates that he believes it is still a possibility that the state had obtained. Statives, being unbounded, can hold on the whole path from ( $\langle w'/w, t' \rangle$ ) to infinity, hence the epistemic possibility is open at the reference time (which is the utterance time  $t_u$ ).

(The Italian version of) (2-a) is also calculated at  $t_u$  where the issue is settled. The combination of tense and aspect does not by itself allow the calculation that the speaker knows  $\neg\phi$  at  $w, t$ . In our system,  $\phi$  is still possible in a counterfactual world where the president is dead, as the preference for the use of the conditional over the imperfect reveals.

When the **present perfect** (see [9]) scopes above the modal (7-c) applies (see [9] for details and discussion).

- (7) a. Mario a pu<sub>pres.perf</sub> prendere le train / \*ha potuto<sub>pres.perf</sub> prendere il treno / *He might have taken the train*  
 b. Mario ha potuto<sub>present.perfect</sub> essere bello / *He might have been handsome*  
 c. Speaker utters  $\phi$  :  $\phi = \lambda w \exists t', t, s [now \subseteq t \wedge Q(s, w) \wedge t \subseteq Q(s, w) \wedge t' \prec t \wedge \exists w' [R(w', w) \wedge \exists e [P(e) \wedge \tau(e, w') \subseteq [t', \_]]]]$  (see also [9]<sup>1</sup>)  
 Hearer :  $K_j[\lambda t \lambda w [(\phi)]^{w,t}] = 1$  iff  $\phi \in \langle w, t \rangle$

In the case of the **eventive** with a possibility modal under the bounded past (present perfect or simple past), as in (7-a), a different scenario emerges, represented as *PAST(BND)( $\diamond(\phi_{bounded})$ )* (a head *PRES* is added for the present perfect [11]). Since *potere* in Italian (7-a) is not allowed (see [4]), we show here how to extend the present approach to French, without assuming a specific lexical semantics of the present perfect as point of view aspect (the simple past in French would not have an epistemic interpretation due to the concurrence between the two tenses (see [11],[14]); also, we consider that the result state of the present perfect at *PRES* ([11]) plays the same contribution as the non grammaticalized present argument of simple past ([13]), whose contribution is to provide an anchor to  $K$ ; see [4] and

<sup>1</sup>[9] does not adopt a branching time framework, though

[7]). Here the speaker knows that the event is no longer possible in the current world and thus puts a bounded aspect on the modal of possibility. No implicature can be calculated about the speaker's belief that  $\neg\phi$ , and as  $\phi$  is also not implicated (see above), the hearer may thus conclude that the speaker's epistemic state is impoverished, i.e. he has no belief that either  $\phi$  or  $\neg\phi$ . In this scenario, the speaker holds both  $\phi$  worlds and  $\neg\phi$  worlds as candidates for the actual world. The inability to distinguish these worlds characterizes the speaker's epistemic state at  $t_u$ , and the hearer can derive  $\neg K_j\phi \wedge \neg K_j\neg\phi$ .

And finally, when the **stative** verb is under the scope of a modal with bounded aspect (7-b) ( $PAST(BND(\diamond(\phi_{unbounded})))$ ), this feature of bounding forces the state to be bounded (we agree with [4] and [8] see also [9], although we do not admit that the modal outscopes tense). For example, in (7-b), the only reading of this sentence that is felicitous is if the speaker considers Mario to be dead, as in this case the state of his being handsome would necessarily have ended (Space limitations inhibit discussion of why the lifetime effect is allowed with ILP under modals, but not outside the modality ([9])). The mechanics of the interpretation applies as in (7-c).

### Selected references.

- [1] Boogaart, R. (2005). The past and perfect of epistemic modals. *Cahiers Chronos* 5
- [2] Condoravdi, C. (2001). Temporal interpretations of modals. Modals for the present and for the past. In D. Beaver & al. (eds.) *Stanford Papers on Semantics*, CSLI Publications.
- [3] von Stechow, P. and Gillies, A. 2008. 'CIA leaks', *Philosophical Review* 117(1) : 77-98.
- [4] Hacquard, V. (2006). Aspects of Modality. PhD Diss., MIT.
- [5] Hintikka, J. (1962). Knowledge and Belief.
- [6] Homer, V. (2009). Epistemic modality and indexicality. NELS 40.
- [7] Kratzer, A. (2009). Modality, content and context. IJN Conferences.
- [8] Laca, B. (2008). On modal tenses and tensed modals. Invited Talk at *Chronos 2008*.
- [9] Mari, A. (2010). Temporal reasoning and modality. Invited talk at *Temptytac. Paris VIII*.
- [10] Martin, F. (2009). Epistemic Modals in the Past. Ms. Stuttgart.
- [11] Schaden, G. (2009). Present perfect compete. L&P.
- [12] de Swart, H. (2007). A cross-linguistic discourse analysis of the perfect. *Journal of Pragmatics*, 39/12.
- [13] Stowell, T. (2007). The Syntactic expression of Tense. *Lingua* 117(2) : 437-463.
- [14] Squartini, M & Bertinetto (2000) The Simple and Compound Past in Romance languages, in *Tense and Aspect in the languages of Europe*.